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U. S. FOREST SERVICE

Pacific Northwest Research Note

FOREST AND RANGE EXPERIMENT STATION · U.S. DEPARTMENT OF AGRICULTURE · PORTLAND, OREGON

PNW-17 September 1964

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A MEASURE OF WIND-CAUSED FUELS

by

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A major windstorm hits the Pacific Northwest every decade or so. Enormous amounts of timber are blown down by these winds, and the resulting problems of salvage, insects, and fire hazard are well known to foresters. But what of the problems in forest areas where no blowdown occurs but where the wind creates significant quantities of ground fuel in the form of tops and branches? Methods of measuring blowdown (whole trees) are well defined and the effects of blowdown on fire problems have been estimated, but blowoff (tops and branches only) has received much less attention. Protection agencies recognize this increase in blowoff fuel, but their methods of measuring it are not well defined and tend to overestimate the amount. A practicable method of measuring increases in wind-caused fuel would be useful to these agencies. Ideally, data such as N acres covered with X amounts of fuel distributed in manner Y should be recorded.

Measurement System Tested

An especially severe windstorm hit the Pacific Northwest on October 12, 1962, emphasizing the need for a reliable wind-caused fuel sampling system. Ten months after the October 12 storm, 4-milacre circular plots were established at 1-chain intervals in a stand of 60- to 70-year-old Douglas-fir in northwest Oregon. The 4-milacre plot size was chosen for its convenience. An estimate of the proportion of ground covered by branches and tops was made on each milacre quadrant. The proportion of ground covered was recorded in units of one-fifths of the total quadrant area (table 1); for example, 40-percent cover was recorded as two-fifths.

In this stand, about 43 percent of the ground was covered with tops and branches. Vertical dimensions of the fuel were not considered in this sample. With a larger sample, fuel continuity could have been determined by plotting the samples on a map, much the same way a type map is constructed.

The merits of this system of measuring blowoff are that it is both easy to teach and to use in the field. No precise measurements are needed

in the field work; interplot distances can be paced, the plot size is small enough to be easily estimated, and the one-fifths covered by fuel are readily determined. With a little practice, a qualified man can collect field data almost as fast as he can walk. The office analysis of the data is uncomplicated and the overall reliability of the method ought to be similar to other systematic sampling techniques.

Table 1.--Field tally of proportion of ground covered by blowoff fuel

(In one-fifths of milacre quadrant)

Plot	Milacre quadrants				Average number of one-fifths by milacre quadrants	Percent cover of 4-milacre plot
	1	2	3	4		
1	1	0	0	1	0.50	10
2	2	3	2	4	2.75	55
3	2	0	1	1	1.00	20
4	1	0	0	1	.50	10
5	1	1	4	1	1.75	35
6	4	2	2	2	2.50	50
7	3	3	1	2	2.25	45
8	1	5	5	4	3.75	75
9	4	3	2	0	2.25	45
10	1	2	1	3	1.75	35
11	3	2	0	0	1.25	25
12	2	2	4	2	2.50	50
13	5	5	5	5	5.00	100
14	2	2	2	3	2.25	45
15	1	2	3	4	2.50	50
16	4	3	2	1	2.50	50
17	0	1	3	1	1.25	25
Total	--	--	--	--	36.25	725
Average	--	--	--	--	1/ 2.13	42.6

1/ $\frac{2.13}{5} \times 100 = 42.6$-percent cover.

The disadvantages of this system are apparent, as are those of any similar or comparable system. The estimator has to decide what is blowoff fuel and what is not. Bias will be difficult to avoid since the areas with blowoff will have to be arbitrarily separated from areas with too little blowoff to be of significant hazard.

General Observations

The field test of this method yielded some unexpected information. It seemed logical that areas adjacent to heavy blowdown would have had numerous tops and branches broken off; however, this was generally not the case. Blowoff in old-growth timber was slight; usually, the whole tree went down or nothing. This was most apparent along the edges of blowdown where trees 3 feet in diameter were twisted and broken, while a few feet away in the standing timber no sign of broken branches or tops appeared.

The 50- to 100-year-age stands, or those about 50 to 125 feet in height, seemed to be highly susceptible to blowoff. Usually, no blowoff occurred in stands under 50 years, and stands older than 100 years behaved much as did old growth. Within 1 year after the storm, all of the needles had dropped off the branches, greatly decreasing fire hazard. Fine twigs and larger limbs covered the ground to a depth of 6 inches in some locations (fig. 1). There were some concentrations of fuel whose depths could be measured in terms of feet (fig. 2). The small number of these heavier concentrations probably would not significantly increase the overall rate of spread of a ground fire. Figure 3 illustrates the general appearance of blowoff near the edge of a stand in the 50- to 100-year age class.

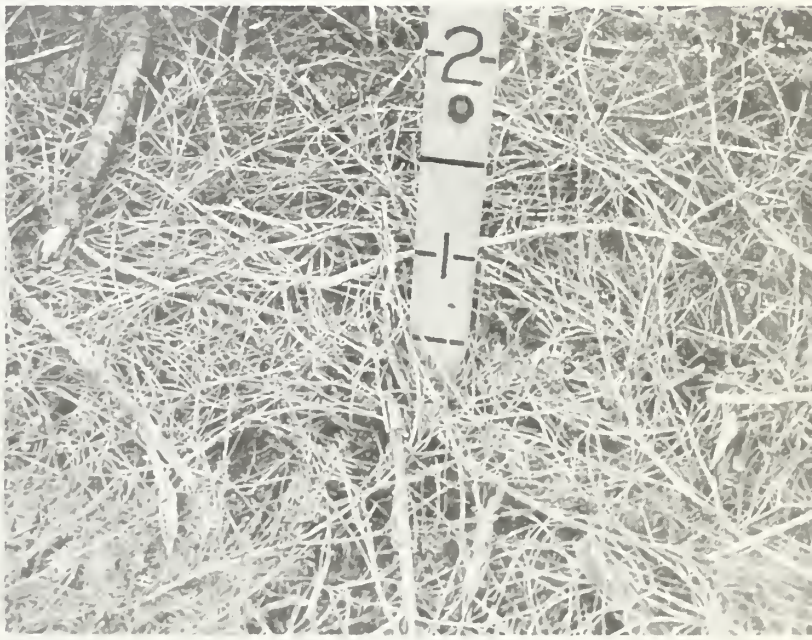

Figure 1.--Blowoff of fine twigs and branches 6 inches deep beneath Douglas-fir in the 50- to 100-year age class.

There were two reports of wind damage in thinned stands. One described more damage in thinned than unthinned stands, while the other report showed more damage in the unthinned. This may indicate that factors other than spacing of the trees have more influence on wind damage.

Summary

Following high winds, damage in the form of tops and branches on the ground commonly occurs in 50- to 100-year-old stands but is not often found in very young stands or in old growth. A method of measuring this blowoff, utilizing an estimate of the proportion of the ground covered by wind-caused fuel, shows promise.

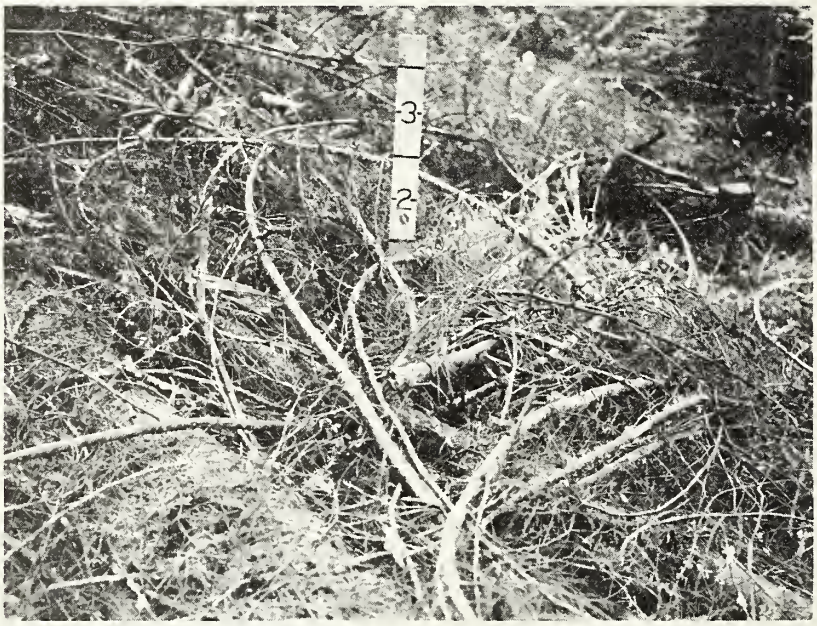

Figure 2.--A heavy concentration of blowoff branches and tops 1-1/2 feet deep beneath Douglas-fir in the 50- to 100-year age class.

Figure 3.--Blowoff on the forest floor near the edge of a Douglas-fir stand in the 50- to 100-year age class.